

WHAT IS CLAIMED IS:

1. A method of assembling a laminated electro-mechanical structure, comprising:
 - (a) stacking a plurality of structural layers to form a stack, wherein the plurality of structural layers has a first structural layer having a movable element formed therein; and
 - (b) attaching each structural layer of the stack to an adjacent structural layer of the stack.
2. The method of claim 1, wherein step (a) comprises: aligning the structural layers in the stack.
3. The method of claim 1, wherein said stacking step comprises: positioning a further structural layer having a permanent magnet in the stack.
4. The method of claim 1, wherein said stacking step comprises: positioning a further structural layer having a high permeability magnetic material in the stack.
5. The method of claim 1, wherein said stacking step comprises: positioning a further structural layer having at least a portion of an electromagnet in the stack.
6. The method of claim 1, wherein said stacking step comprises: positioning in the stack a further structural layer having at least one electrical contact area formed thereon.
7. The method of claim 1, wherein said stacking step comprises: positioning the first structural layer having the movable element in the stack.

8. The method of claim 7, wherein said stacking step further comprises:
positioning in the stack a second structural layer having an opening therethrough to form a cavity.
9. The method of claim 8, wherein said second structural layer positioning step comprises:
positioning the second structural layer in the stack adjacent to the first structural layer such that the movable element moves in the cavity during operation of the movable element.
10. The method of claim 1, wherein said forming step comprises:
forming the movable element in the first structural layer so that the movable element is capable of moving in a plane that is coplanar with the first structural layer.
11. The method of claim 1, wherein said forming step comprises:
forming the movable element in the first structural layer so that the movable element is capable of moving outside of a plane that is coplanar with the first structural layer.
12. The method of claim 1, wherein step (b) comprises:
prior to step (a), applying an adhesive material to at least one opposing surface of each pair of adjacent structural layers of the stack.
13. The method of claim 12, wherein the adhesive material is an epoxy, wherein said applying step comprises:
applying the epoxy to the at least one opposing surface of each pair of adjacent structural layers of the stack.
14. The method of claim 13, wherein step (b) further comprises:

after step (a), curing the epoxy applied to the at least one opposing surface of each pair of adjacent structural layers of the stack.

15. The method of claim 14, wherein said curing step comprises:
heating the stack to cure the epoxy.
16. The method of claim 1, further comprising the step of:
(c) prior to step (a), forming the plurality of structural layers.
17. The method of claim 16, wherein step (c) comprises:
forming a structural layer that includes a permanent magnet.
18. The method of claim 16, wherein step (c) comprises:
forming a structural layer that includes a high permeability magnetic material.
19. The method of claim 16, wherein step (c) comprises:
forming a structural layer that includes at least a portion of an electromagnet.
20. The method of claim 16, wherein step (c) comprises:
forming at least one electrical contact area on a surface of a structural layer.
21. The method of claim 16, wherein step (c) comprises:
forming a structural layer having an opening therethrough.
22. The method of claim 16, wherein step (c) comprises:
forming the first structural layer having the movable element.

23. The method of claim 22, wherein said step of forming the first structural layer comprises:

forming the movable element in the first structural layer; and

forming at least one flexure portion in the first structural layer that is mechanically coupled to the movable element.

24. The method of claim 22, wherein said step of forming the first structural layer comprises:

forming at least one contact area in the first structural layer that is electrically coupled to the movable element.

25. The method of claim 16, wherein the laminated electro-mechanical structure includes a latching switch, wherein step (c) comprises:

forming at least one electronic component on a surface of a structural layer of the plurality of structural layers; and

electrically coupling the at least one electronic component to the latching switch.

26. The method of claim 25, wherein the at least one electrical component includes at least one of an inductor, a capacitor, and a resistor, wherein said electronic component forming step includes:

forming the at least one of an inductor, a capacitor, and a resistor on the surface of the structural layer of the plurality of structural layers.

27. The method of claim 16, wherein the laminated electro-mechanical structure includes a latching switch, wherein step (c) comprises:

forming an antenna pattern on a surface of a structural layer of the plurality of structural layers; and

electrically coupling the antenna pattern to the latching switch.

28. A micro-magnetic latching switch assembled in accordance with the method of claim 1.

29. A plurality of micro-magnetic latching switches assembled in accordance with the method of claim 1.

30. A magnetic latching switch assembled in accordance with the method of claim 1.

31. A plurality of magnetic latching switches assembled in accordance with the method of claim 1.

32. A plurality of stacked magnetic latching switches made in accordance with the method of claim 1.

33. A plurality of laterally spaced magnetic latching switches made in accordance with the method of claim 1.

34. A method of assembling a laminated micro-mechanical structure, comprising:

(a) stacking a plurality of structural layers to form a stack, wherein the plurality of structural layers has a first structural layer having a movable element formed therein; and

(b) attaching each structural layer of the stack to an adjacent structural layer of the stack.

35. The method of claim 34, wherein step (a) comprises:
aligning the structural layers in the stack.

36. The method of claim 34, wherein said stacking step comprises:

positioning a further structural layer having a permanent magnet in the stack.

37. The method of claim 34, wherein said stacking step comprises:
positioning a further structural layer having a high permeability magnetic material in the stack.

38. The method of claim 34, wherein said stacking step comprises:
positioning a further structural layer having at least a portion of an electromagnet in the stack.

39. The method of claim 34, wherein said stacking step comprises:
positioning in the stack a further structural layer having at least one electrical contact area formed thereon.

40. The method of claim 34, wherein said stacking step comprises:
positioning the first structural layer having the movable element in the stack.

41. The method of claim 40, wherein said stacking step further comprises:
positioning in the stack a second structural layer having an opening therethrough to form a cavity.

42. The method of claim 41, wherein said second structural layer positioning step comprises:
positioning the second structural layer in the stack adjacent to the first structural layer such that the movable element moves in the cavity during operation of the movable element.

43. The method of claim 34, wherein said forming step comprises:

forming the movable element in the first structural layer so that the movable element is capable of moving in a plane that is coplanar with the first structural layer.

44. The method of claim 34, wherein said forming step comprises:

forming the movable element in the first structural layer so that the movable element is capable of moving outside of a plane that is coplanar with the first structural layer.

45. The method of claim 34, wherein step (b) comprises:

prior to step (a), applying an adhesive material to at least one opposing surface of each pair of adjacent structural layers of the stack.

46. The method of claim 45, wherein the adhesive material is an epoxy, wherein said applying step comprises:

applying the epoxy to the at least one opposing surface of each pair of adjacent structural layers of the stack.

47. The method of claim 46, wherein step (b) further comprises:

after step (a), curing the epoxy applied to the at least one opposing surface of each pair of adjacent structural layers of the stack.

48. The method of claim 47, wherein said curing step comprises:

heating the stack to cure the epoxy.

49. The method of claim 34, further comprising the step of:

(c) prior to step (a), forming the plurality of structural layers.

50. The method of claim 49, wherein step (c) comprises:

forming a structural layer that includes a permanent magnet.

51. The method of claim 49, wherein step (c) comprises:
forming a structural layer that includes a high permeability magnetic material.
52. The method of claim 49, wherein step (c) comprises:
forming a structural layer that includes at least a portion of an electromagnet.
53. The method of claim 49, wherein step (c) comprises:
forming at least one electrical contact area on a surface of a structural layer.
54. The method of claim 49, wherein step (c) comprises:
forming a structural layer having an opening therethrough.
55. The method of claim 49, wherein step (c) comprises:
forming the first structural layer having the movable element.
56. The method of claim 55, wherein said step of forming the first structural layer comprises:
forming the movable element in the first structural layer; and
forming at least one flexure portion in the first structural layer that is mechanically coupled to the movable element.
57. The method of claim 55, wherein said step of forming the first structural layer comprises:
forming at least one contact area in the first structural layer that is electrically coupled to the movable element.
58. The method of claim 49, wherein the laminated micro-mechanical structure includes a latching switch, wherein step (c) comprises:

forming at least one electronic component on a surface of a structural layer of the plurality of structural layers; and

electrically coupling the at least one electronic component to the latching switch.

59. The method of claim 58, wherein the at least one electrical component includes at least one of an inductor, a capacitor, and a resistor, wherein said electronic component forming step includes:

forming the at least one of an inductor, a capacitor, and a resistor on the surface of the structural layer of the plurality of structural layers.

60. The method of claim 58, wherein the laminated micro-mechanical structure includes a latching switch, wherein step (c) comprises:

forming an antenna pattern on a surface of a structural layer of the plurality of structural layers; and

electrically coupling the antenna pattern to the latching switch.

61. A micro-magnetic latching switch assembled in accordance with the method of claim 34.

62. A plurality of micro-magnetic latching switches assembled in accordance with the method of claim 34.

63. A plurality of stacked micro-magnetic latching switches made in accordance with the method of claim 34.

64. A plurality of laterally spaced micro-magnetic latching switches made in accordance with the method of claim 34.